Concluding remarks
Anthony Garratt, Kevin Lee, M. Hashem Pesaran, and Yongcheol Shin

in Global and National Macroeconometric Modelling: A Long-Run Structural Approach

The final chapter provides some concluding comments, including a summary of the main contributions of the book and an invitation to others to apply the methods in new contexts using the data and code provided in the Appendices.

Computing with Cells
Pierluigi Frisco

How could we use living cells to perform computation? Would our definition of computation change as a consequence of this? Could such a cell-computer outperform digital computers? These are some of the questions that the study of Membrane Computing tries to answer and are at the base of what is treated by this monograph. Descriptive and computational complexity of models in Membrane Computing are the two lines of research on which is the focus here. In this context this book reports the results of only some of the models present in this framework. The models considered here represent a very relevant part of all the models introduced so far in the study of Membrane Computing. They are in between the most studied models in the field and they cover a broad range of features (using symbol objects or string objects, based only on communications, inspired by intra- and intercellular processes, having or not having a tree as underlying structure, etc.) that gives a grasp of the enormous flexibility of this framework. Links with biology and Petri nets are constant through this book. This book aims also to inspire research.
This book gives suggestions for research of various levels of difficulty and this book clearly indicates their importance and the relevance of the possible outcomes. Readers new to this field of research will find the provided examples particularly useful in the understanding of the treated topics.

Determining Sample Size

Patrick Dattalo

Published in print: 2008 Published Online: January 2009
Item type: book

Sample size determination is an important and often difficult step in planning an empirical study. From a statistical perspective, sample size depends on the following factors: type of analysis to be performed, desired precision of estimates, kind and number of comparisons to be made, number of variables to be examined, and heterogeneity of the population to be sampled. Other important considerations include feasibility, such as ethical limitations on access to a population of interest and the availability of time and money. The primary assumption of the book is that, within the context of ethical and practical limitations, efforts to obtain samples of appropriate size and quality remain an important and viable component of social science research. This text describes the following available approaches for estimating sample size in social work research and discusses their strengths and weaknesses: power analysis; heuristics or rules-of-thumb; confidence intervals; computer-intensive strategies; and ethical and cost considerations. In addition, strategies for mitigating pressures to increase sample size, such as emphasis on model parsimony (e.g., fewer dependent and independent variables), simpler study designs, an emphasis on replication, and careful planning of analyses are discussed. The book covers sample-size determination for advanced and emerging statistical strategies, such as structural equation modeling, multi-level analysis, repeated measures MANOVA, and repeated measures ANOVA which are not discussed in other texts.

Networks

Mark Newman

Published in print: 2010 Published Online: September 2010
Item type: book

The scientific study of networks, including computer networks, social networks, and biological networks, has received an enormous amount
of interest in the last few years. The rise of the Internet and the wide availability of inexpensive computers have made it possible to gather and analyze network data on a large scale, and the development of a variety of new theoretical tools has allowed us to extract new knowledge from many different kinds of networks. The study of networks is broadly interdisciplinary and important developments have occurred in many fields, including mathematics, physics, computer and information sciences, biology, and the social sciences. This book brings together the most important breakthroughs in each of these fields and presents them in a coherent fashion, highlighting the strong interconnections between work in different areas. Subjects covered include the measurement and structure of networks in many branches of science, methods for analyzing network data, including methods developed in physics, statistics, and sociology, the fundamentals of graph theory, computer algorithms, and spectral methods, mathematical models of networks, including random graph models and generative models, and theories of dynamical processes taking place on networks.

Alan Turing's Automatic Computing Engine
B. Jack Copeland (ed.)

The mathematical genius Alan Turing (1912-1954) was one of the greatest scientists and thinkers of the 20th century. Now well known for his crucial wartime role in breaking the ENIGMA code, he was the first to conceive of the fundamental principle of the modern computer — the idea of controlling a computing machine's operations by means of coded instructions, stored in the machine's 'memory'. In 1945, Turing drew up his revolutionary design for an electronic computing machine — his Automatic Computing Engine (‘ACE’). A pilot model of the ACE ran its first programme in 1950 and the production version, the ‘DEUCE’, went on to become a cornerstone of the fledgling British computer industry. The first ‘personal’ computer was based on Turing's ACE. This book describes Turing's struggle to build the modern computer. It contains first-hand accounts by Turing and by the pioneers of computing who worked with him. The book describes the hardware and software of the ACE and contains chapters describing Turing's path-breaking research in the fields of Artificial Intelligence (AI) and Artificial Life (A-Life).
Digital Applications in Law Enforcement
James W. Cortada


This chapter discusses technologies adopted by the law enforcement community over a half century. Specifically, it looks at the use of computing by policing agencies, courts, and corrections, with a brief introduction to the early history of computer crime as it currently represents a new class of criminal activity made possible by the existence of the digital hand.

The Metaphysics of Virtual Reality
Michael Heim

Computers have dramatically altered life in the late 20th century. Today we can draw on worldwide computer links, speeding up communications for radio, newspapers, and television. Ideas fly back and forth and circle the globe at the speed of electricity. And just around the corner lurks full-blown virtual reality, in which we will be able to immerse ourselves in a computer simulation not only of the actual physical world, but of any imagined world. As we begin to move in and out of a computer-generated world, this book asks, how will the way we perceive our world change? This book considers this and other philosophical issues of the Information Age. With an eye for the dark as well as the bright side of computer technology, it explores the logical and historical origins of our computer-generated world and speculates about the future direction of our computerized lives. The book discusses such topics as the effect of word-processing on the English language. The book also looks into the new kind of literacy promised by Hypertext. And it also probes the notion of virtual reality, “cyberspace”—the computer-simulated environments that have captured the popular imagination and may ultimately change the way we define reality itself. Just as the definition of interface itself has evolved from the actual adaptor plug used to connect electronic circuits into human entry into a self-contained cyberspace, so too will the notion of reality change with the current technological drive. Like the
introduction of the automobile, the advent of virtual reality will change the whole context in which our knowledge and awareness of life are rooted. And along the way, the book covers such intriguing topics as how computers have altered our thought habits, how we will be able to distinguish virtual from real reality, and the appearance of virtual reality in popular culture (as in Star Trek's holodeck, William Gibson's Neuromancer, and Stephen King's Lawnmower Man).

Introduction to Modeling Convection in Planets and Stars
Gary A. Glatzmaier

This book provides readers with the skills they need to write computer codes that simulate convection, internal gravity waves, and magnetic field generation in the interiors and atmospheres of rotating planets and stars. Using a teaching method perfected in the classroom, the book begins by offering a step-by-step guide on how to design codes for simulating nonlinear time-dependent thermal convection in a 2D box using Fourier expansions in the horizontal direction and finite differences in the vertical direction. It then describes how to implement more efficient and accurate numerical methods and more realistic geometries in two and three dimensions. The third part of the book demonstrates how to incorporate more sophisticated physics, including the effects of magnetic field, density stratification, and rotation. The book features numerous exercises throughout, and is an ideal textbook for students and an essential resource for researchers. It explains how to create codes that simulate the internal dynamics of planets and stars, and builds on basic concepts and simple methods. The book shows how to improve the efficiency and accuracy of the numerical methods. It considers more relevant geometries and boundary conditions.

Statistics, Data Mining, and Machine Learning in Astronomy
Željko Ivezic, Andrew J. Connolly, Jacob T VanderPlas, and Alexander Gray

As telescopes, detectors, and computers grow ever more powerful, the volume of data at the disposal of astronomers and astrophysicists will enter the petabyte domain, providing accurate measurements for billions of celestial objects. This book provides a comprehensive and
accessible introduction to the cutting-edge statistical methods needed to efficiently analyze complex data sets from astronomical surveys such as the Panoramic Survey Telescope and Rapid Response System, the Dark Energy Survey, and the upcoming Large Synoptic Survey Telescope. It serves as a practical handbook for graduate students and advanced undergraduates in physics and astronomy, and as an indispensable reference for researchers. The book presents a wealth of practical analysis problems, evaluates techniques for solving them, and explains how to use various approaches for different types and sizes of data sets. For all applications described in the book, Python code and example data sets are provided. The supporting data sets have been carefully selected from contemporary astronomical surveys (for example, the Sloan Digital Sky Survey) and are easy to download and use. The accompanying Python code is publicly available, well documented, and follows uniform coding standards. Together, the data sets and code enable readers to reproduce all the figures and examples, evaluate the methods, and adapt them to their own fields of interest.

Internal Gravity Waves
Gary A. Glatzmaier

in Introduction to Modeling Convection in Planets and Stars: Magnetic Field, Density Stratification, Rotation

This chapter focuses on internal gravity waves in a stable thermal stratification. When the amplitude of the fluid velocity is small relative to the amplitude of the phase velocity, a linear analysis, which neglects advection, provides insight to the relation between the wavelength and frequency of internal gravity waves. Furthermore, when thermal and viscous diffusion play relatively minor roles the system can be further simplified by neglecting diffusion. The chapter first describes the linear dispersion relation before discussing the computer code modifications and simulations. In particular, it explains what modifications would be needed to convert one's thermal convection code to a code that simulates internal gravity waves, including the nonlinear and diffusive terms. Finally, it considers the computer analysis of wave energy.
This book presents an interdisciplinary discussion of the important methodological tool known as prosopography — the collection of all known information about individuals within a given period. With the advent of computer technology it is now possible to gather and store such information in increasingly sophisticated and searchable databases, which can bring a new dimension to traditional historical research. The book surveys the transition in prosopographical research from more traditional methods to the new technology, and discusses the central role of the British Academy, as well as that of French, German and Austrian academic institutions, in developing prosopographical research on the Later Roman Empire, Byzantium and now Anglo-Saxon and other periods. The chapters discuss both national histories of the discipline and its potential for future research. The book demonstrates mutual benefits and complementarity in such studies between the use of new technology and the highest standards of traditional scholarship, and in doing so it sets forth new perspectives and methodologies for future work.

In this book, Susan Brenner analyzes the complex and evolving interactions between law and technology and provides a thorough and detailed account of the law in technology at the beginning of the 21st century. She draws upon recent technological advances, evaluating how developing technologies may alter how humans interact with each other and with their environment. She analyzes the development of technology as shifting from one of “use” to one of “interaction,” and argues that this interchange requires us to reconceptualize our approach to legal rules, which were originally designed to prevent the “misuse” of older technologies. Brenner argues that as technologies continue to evolve, the laws targeting the relationship between humans and technology must become, and should remain, neutral. She explains how older technologies rely on human implementation, but new, “smart” technologies are intelligent and autonomous, in varying degrees.
This, she notes, will eventually lead to the ultimate progression in our relationship with technology: the fusion of human physiology and technology. Law in an Era of “Smart” Technology provides a detailed, historically-grounded analysis of why our traditional relationship with technology is evolving in ways that require a corresponding shift in our law.

Frege on Definitions
John Hory

This book explores the difficulties presented for Gottlob Frege's semantic theory, as well as its modern descendents, by the treatment of defined expressions. The book begins by focusing on the psychological constraints governing Frege's notion of sense, or meaning, and argues that, given these constraints, even the treatment of simple stipulative definitions led Frege to important difficulties. This book suggests ways out of these difficulties that are both philosophically and logically plausible and Fregean in spirit. This discussion is then connected to a number of more familiar topics, such as indexicality and the discussion of concepts in recent theories of mind and language. The latter part of the book, after introducing a simple semantic model of senses as procedures, considers the problems that definitions present for Frege's idea that the sense of an expression should mirror its grammatical structure. The requirement can be satisfied, the book argues, only if defined expressions—and incomplete expressions as well—are assigned senses of their own, rather than treated contextually. The book then explores one way in which these senses might be reified within the procedural model, drawing on ideas from work in the semantics of computer programming languages. With its combination of technical semantics and history of philosophy, the book tackles some of the hardest questions in the philosophy of language.

Transportation, Communication, Information:
Vaclav Smil

in Transforming the Twentieth Century: Volume 2: Technical Innovations and Their Consequences
Private transportation was transformed by mass ownership of automobiles while long-distance public transport benefited from new high-speed trains and from affordable flying. Freight transportation was transformed by containers moved by ships, trains, and trucks. Communication and the processing and dissemination of information were revolutionized first by transistors, then by integrated circuits and microprocessors, the key components of mainframe and personal computers, televisions, and a multitude of electronic devices, many of them now taking advantage of the Internet.

Television and New Media Audiences
Ellen Seiter

Published in print: 1998 Published Online: October 2011
Item type: book

Why is talk about television forbidden at certain schools? Why does a mother feel guilty about watching Star Trek in front of her four-year-old child? Why would retired men turn to daytime soap operas for entertainment? Clichés about television mask the complexity of our relationship to media technologies. Through case studies, this book explains what audience research tells us about the uses of technologies in the domestic sphere and the classroom, the relationship between gender and genre, and the varied interpretation of media technologies and media forms. This book reviews the most important research on television audiences and recommends the use of ethnographic, longitudinal methods for the study of media consumption and computer use at home as well as in the workplace. The book discusses reactions of audiences to many internationally known television programmes including The Flintstones, The Jetsons, Street Fighter, Mighty Morphin Power Rangers, X-Men, Sesame Street, Dallas, Star Trek, The Cosby Show, Teenage Mutant Ninja Turtles, and National Geographic.

Changing Boundaries of Firms in the Evolution of the Computer Industry: Towards a History-Friendly Model
Franco Malerba, Richard Nelson, Luigi Orsenigo, and Sidney Winter

in Flexibility and Stability in the Innovating Economy

Published in print: 2006 Published Online: May 2006
Item type: chapter
This chapter analyzes the changing boundaries of firms in terms of vertical integration and dis-integration (specialization) in dynamic and uncertain technological and market environments. In particular, it addresses the question of stability and change in firms’ decisions to ‘make or buy’ in contexts characterized by periods of technological revolutions punctuating periods of relative technological stability and smooth technical progress. The chapter is inspired by the case of the computer and semiconductor industries, and proposes the building blocks of a model in the ‘history-friendly’ style, showing how alternative dynamics of demand and technical change might generate profoundly different patterns of evolution in the two industries. The main argument proposed concerns the role of co-evolution in the upstream and downstream industries in explaining the changing boundaries of firms.

The Digital Hand, Vol 3
James W. Cortada

Published in print: 2007 Published Online: January 2008
Published Online: January 2008
DOI: 10.1093/acprof:oso/9780195165869.001.0001
Item type: book

This book, the third of three volumes, completes the sweeping survey of the effect of computers on American industry began in the first volume and continued in the second volume. It turns finally to the public sector, examining how computers have fundamentally changed the nature of work in government and education. This book goes far beyond generalizations about the Information Age to the specifics of how industries have functioned, now function, and will function in the years to come. The book provides a broad overview of computing's and telecommunications' role in the entire public sector, including federal, state, and local governments, and in K-12 and higher education. Beginning in 1950, when commercial applications of digital technology began to appear, the book examines the unique ways different public sector industries adopted new technologies, showcasing the manner in which their innovative applications influenced other industries, as well as the US economy as a whole. The book builds on the surveys presented in the first volume, which examined sixteen manufacturing, process, transportation, wholesale and retail industries, and the second volume, which examined over a dozen financial, telecommunications, media, and entertainment industries. This book completes the trilogy and provides a picture of what the infrastructure of the Information Age really looks like and how we got there.
There is a continuing growth of interest in the computer simulation of materials at the atomic scale, using a variety of academic and commercial computer programs. In all such programs there is some physical model of the interatomic forces. For a student or researcher, the basis of such models is often shrouded in mystery. It is usually unclear how well founded they are, since it is hard to find a discussion of the physical assumptions that have been made in their construction. The lack of clear understanding of the scope and limitations of a given model may lead to its innocent misuse, resulting either in unfair criticism of the model or in the dissemination of nonsensical results. In this book, models of interatomic forces are derived from a common physical basis, namely the density functional theory. The book includes the detailed derivation of pairwise potentials in simple metals, tight-binding models from the simplest to the most sophisticated (self-consistent) kind, and ionic models. It provides a critical appreciation of the broad range of models in current use, and provides the tools for understanding other variants that are described in the literature. Some of the material is new, and some pointers are given to possible future avenues of model development.

Business Patterns and Digital Applications in the Transformation of Manufacturing Industries

James W. Cortada

This chapter is a history of key computer applications in manufacturing across three periods of time, beginning in the 1940s and extending to the early 2000s. Key uses included business and accounting, numerical control, integrated computer manufacturing, CAD/CAM, Computer Aided Manufacturing, robotics, and flexible manufacturing systems (FMS). It concludes with a description of supply chains and extent of deployment of all uses in manufacturing.
This chapter explains how to write a postprocessing code, and more specifically how to study the nonlinear simulations using computer graphics and analysis. It first considers how to compute and store results in a file during the computer simulation, assuming the Fourier transforms to x-space are done within the main computational code during the simulation. It then describes the postprocessing code for reading these files and displaying the various fields, along with the use of graphics software packages that provide additional, more sophisticated visualizations of the scalar and vector data. It also discusses the computer analysis of several additional properties of the solution, focusing on measurements of nonlinear convection such as Rayleigh number, Nusselt number, Reynolds number, and kinetic energy spectrum.